

An iconography of *Ministrombus* Dekkers, 2010 (Gastropoda: Neostromboidae: Strombidae) with the description of new species

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ABSTRACT This iconography explores the variability and ranges of members of the *Ministrombus* and introduces three new species bringing the total to six in the genus. Two of these species are alluded to in previous works but were never described. *M. athenius* is recircumscribed and the type locality is shifted to reflect this change in taxonomic position. This paper examined 430 specimens, and used morphology and distribution patterns to delineate species. There is considerable variability in the form of each species; however, within each species complex, there are distinctive characteristics that enable taxonomic resolution. This paper adds to the growing understanding of diversity within Neostromboidae, and highlights the revisions of what are currently considered stable taxa increasing our understanding of global biodiversity.

KEYWORDS Indonesia, Marshall Islands, New species, New Caledonia, Queensland, *Strombus*

INTRODUCTION

Stromboideans are a diverse group of marine snails that have undergone a renaissance in taxonomy with many new revisions in its internal composition and higher taxonomic relationships (Maxwell *et al.* 2019, 2020a, 2020b; Dekkers and Maxwell 2020; Maxwell and Dekkers 2021a, 2021b). However, while these revisions have led to greater clarity in the understanding of internal evolutionary relationships, many of the genera contained within the complex are still in need of revision given the increasing availability of comparative material, more nuanced understanding of distributions and access to type material.

The *Ministrombus* Dekkers, 2010 are a group of small to medium sized stromboideans that are restricted to the Central Indo-Pacific region. Once considered members of the *Dolomena*, *Ministrombus minimus* (Linné, 1771) was the first to be placed in *Ministrombus* by Bandel (2007), although there are some problems with

the construction of that genus and it is not compliant with the ICZN, nor is it defined under the PhyloCode (Dekkers and Maxwell 2020; Maxwell 2021). Unintentionally, while Dekkers (2010) accepted Bandel (2007), the author addressed this taxonomic issue, and it is Dekkers (2010) work that is ICZN compliant, and which is registered into the RegNum of the PhyloCode (Maxwell 2021). Furthermore, it was Dekkers (2010) that included *M. variabilis* (Swainson, 1820) in *Ministrombus*.

At present there are three recognised species within *Ministrombus*; *M. athenius* (Duclos in Chenu, 1844), *M. minimus* and *M. variabilis*, with earlier workers hinting that there are more undescribed species hiding within the species complexes (Abbott, 1960). This iconography explores the current taxonomic status and variability of members of *Ministrombus* and seeks to determine a more nuanced understanding of morphological diversity and species composition within the genus.

Abbreviations

SBRF	BlueSky Research Foundation, Cairns, Queensland.
SMC	Stephen Maxwell Collection, Cairns, Queensland.
YC	Trevor and Marguerite Young Collection, Townsville, Queensland.
VC	Valda Cantamessa Collection, Proserpine, Queensland.
VLC	Virgillio Liverani Collection, Faenza, Italy.

METHODS

This study examines specimens from the combined range of the current species contained within *Ministrombus* Dekkers, 2010. Type material and type locations for currently accepted species and their synonyms were identified (Figure 1). Based on this type information, the current taxonomy was explored, and any inconsistency or errors in the current nomenclature were identified and corrected. Organisms that fell outside currently described species morphometric bounds were identified, were mapped to determine distributions (Figure 2), and where they were determined to come from natural bioregional areas and shared distinctive morphological characteristics (Figure 3), these were then set aside for circumscription.

The choice in the use of species or subspecies followed Maxwell and Dekkers (2019; Maxwell *et al.* 2021): species are recognised by phenetic differences in morphology, while subspecies are only able to be discriminated by genetic diversity (Wei *et al.* 2021). A total of six species were delineated from the 430 *Ministrombus* that were examined: *M. athenius* x 144; *M. minimus* x 81; *M. variabilis* x 144; and circumscribed herein *M. aurantius* nov. sp. x 42; *M. caledonicus* nov. sp. x 13; *Ministrombus oceanicus* nov. sp. x 6. PhyloCode (2020)

identification numbers (RegNum) for higher taxonomy have been provided where applicable; the species names were constructed in order to be compliant with the ICZN (1999) to provide a level of taxonomic stability in their application and use.

SYSTEMATIC PART

Superfamily	Stromboidea Rafinesque, 1815
Epifamily	Neostromboidae Maxwell, Dekkers, Rymer and Congdon, 2019 (RegNum 565, Maxwell 2021)
Family	Strombidae Rafinesque, 1815 (RegNum 566, Maxwell 2021)
Subfamily	Neostrombinae Maxwell and Rymer, 2021 (RegNum 567, Maxwell 2021)
Tribe	Dolomenini Dekkers and Maxwell, 2020 (RegNum 580, Maxwell 2021)
Subtribe	Dolomenina Dekkers and Maxwell, 2020 (RegNum 584, Maxwell 2021)

Ministrombus Dekkers, 2010

[Maxwell 2021, *nomen cladi conversum*]

Registration Number. 621.

Definition. The maximum clade consisting of *Ministrombus minimus* (Linné, 1771) and all species that share a more recent common ancestor with them than *Dolomena pulchella* (Reeve, 1851), *Labiostrombus epidromis* (Linné, 1758), *Amabiliplicatus plicatus* (Röding, 1798), *Dominus labiosus* (Wood, 1828), *Pacificus dilatatus* (Swainson, 1821), *Doxander vittatus* (Linné, 1758), *Neodilatilabrum marginatum* (Linné, 1758), *Mirabilistrombus listeri* (Gray, 1852), *Neostrombus fusiformis* (Sowerby II, 1842) or *Laevistrombus vanikorensis* (Quoy and Gaimard, 1834).

Reference Phylogeny. Figure 2 in Dekkers and Maxwell (2020).

Diagnosis. The spire has a distinct shoulder with knobs. The body whorl is shiny and almost without any sculpture except shoulder knobs on dorsum. The expanded outer lip is thickened at the inner edge and is shiny and smooth. The aperture is smooth within, only rarely lirate. The columella is smooth, with a well-defined callous. The anterior canal is short. The stromboid notch is medium deep. The posterior canal is present (Dekkers and Maxwell 2020, p. 47).

Synonymy.

Ministrombus Bandel, 2007, p. 154.

Ministrombus Dekkers, 2010, p. 9.

Type. *Ministrombus minimus* (Linné, 1771).

Ministrombus athenius (Duclos in Chenu, 1844)
(Figures 4 – 5)

Type. Image of lectotype – Duclos in Chenu (1844), pl. 11, fig. 2 (Abbott 1960, p. 104) (Figure 1).

Type Location. I shift the type location designation to Dingo Beach, Queensland. Abbott's designation of Biak Island, Dutch New Guinea is an error (= *Ministrombus aurantius* nov. sp.).

Description. The shell is light and moderately sized being triangulate. Early whorls rounded becoming strong nodulate on latter whorls. The shell is rounded when viewed axially. Nodulations form on latter whorls and are strongly angulate, axially compressed and sharp at the shoulder. The sutures are well below the shoulder. The subsutural ramp is smooth and narrow. The aperture and columella are white. There may be a dark blotch of colour in the middle, but this is not a common feature. The outer lip is thickened, always white, and well calloused, being thin posteriorly where it forms a shallow wide lobe. The outer lip joins the body of the shell between the shoulders of body

whorl and of the penultimate whorl. The posterior sinus is shallow, but well-formed and not calloused. The stromboidean notch is moderately deep and well defined. The stromboidean lobe is well formed and quadrate. The anterior spiral lines are well developed. The anterior canal is straight or slightly recurved, and may extend past the anterior edge of the dorsum. Colour of ventral side varies from white to having bands of maculations or solid lines. The dorsal colouration with five light tan to brown interrupted bands on a white shell, there may be dark axial maculations that vary in width and number.

Synonymy.

Strombus (*Dolomena*) *variabilis* Swainson – Ripplingale and McMichael 1961, 55, pl. 5, fig. 8. Wilson and Gillett 1971, p. 76, pl. 14, figs. 8 and 8a. Wilson and Gillett 1979, p. 76, pl. 14, figs. 8 and 8a. = *Strombus variabilis* Swainson – Hinton 1972, p. 10, pl. 5, fig. 6. Short and Potter 1987, p. 34, pl. 16, fig. 2. Jarrett 2011, p. 50, fig. 136. = *Strombus* (*Dolomena*) *variabilis variabilis* Cernohorsky 1972, p. 79, pl. 18, fig. 10. Kreipl *et al.* 1999, p. 45, pl. 91, fig. 3. = *Dolomena variabilis variabilis* Swainson – Liverani 2014, p. 36, pl. 150, fig. 4. = *Dolomena variabilis* Swainson – Robin 2008, fig. 2.

1844 *Strombus athenius* Dulcos in Chenu, pl. 11, fig. 2. Tryon 1885, p. 117, pl. 6, fig. 61.

Distribution. Literary Records – *Australia* Batt Reef (Abbott 1960); Cooktown (Cernohorsky 1972); Green Island (Abbott 1960); Groote Eylandt, Gulf of Carpentaria (Abbott 1960); Low Island (Abbott 1960; Ripplingale and McMichael 1961); Sweers Island, Gulf of Carpentaria (Abbott 1960); Yirrkala, Arnhemland (Abbott 1960).

Papua New Guinea Gulf of Papua (Hinton 1972). Material Examined – *Australia* Big Sandy, Swains Reef (SMC x 10; VC x 1); Boulton Reef (SMC x 1); Bushy Island (VC x 1); Cairns

Reef (SMC x 1); Cooktown (YC x 1); Diamond Isles (SMC x 1); Dingo Beach (SMC x 17; VC x 21; (YC x 6).); Green Island (SMC x 2; VC x 3); Hook Reef (VC x 3); Hope Island (VC x 1); Mackerel Reef, Swains Reefs (SMC x 2); Michaelmas Cay (SMC x 1; VC x 2); Mid Reef, Horwick Reef (SMC x 4); Palm Island (SMC x 1; VC x 1); Perfect Reef, Swains Reefs (SMC x 7; VC x 11); Port Douglas (VC x 3); Prong Reef no 2, Swains Reefs (SMC x 1); Prong Reef, Swains Reefs (SMC x 1); Saumarez Reef (SMC x 2); Slashers Reef (VC x 2); St Crispins Reef (VC x 2); Swains Reefs (SMC x 5; VC x 9; (YC x 12); Trunk Reef (SMC x 3); Undine Reef (SMC x 2); Yamacutter Reef (SMC x 1). *Papua New Guinea* Milne Bay (SMC x 3).

Ministrombus minimus (Linné, 1771)
(Figures 6 – 7)

Type. Image of holotype – Rumphius (1705, 1741) pl. 36, fig. P (Figure 1).

Type Location. Cebu Island, Philippines (Abbott 1960).

Original Description. “*Strombus testæ labro retuso gibbo, ventre spiraque plicato-nodosus, apertura bilabiate lævi*” (Linné 1771, p. 549).

Supplementary Diagnosis. The small shell is heavy and ventro-dorsally compressed. The early spire is rounded with fine spiral striations. The later spire becoming nodulate at the shoulder with distinctive shoulder knobs that are raised and axially elongated reaching to the suture. These nodules diminish on, and are lost on, the body whorl. The suture of whorls is well below the shoulder. The ventral body whorl is smooth and flattened with a strong axial fold. The anterior of the shell typically has well-defined, evenly spaced incised lines that continue to the edge of the outer lip on the dorsal side. The whole columella is heavily calloused the length of the aperture but does not extend onto the short anterior canal. The outer lip is heavily calloused, with a wide posterior

lobe where the outer lip meets the body whorl. The posterior sinus is well formed and strongly bilabially calloused. The stromboidian notch is moderately formed and the lobe is broad and not extended. The aperture is white and may have a distinctive yellow staining on the inner surface. The colour of the shell is variable, early whorls being uniform white to tan, with later whorls developing patterns that consist of four bands of fine maculations and axial lines that may form blocks of colour and merge giving rise to chocolate or tan shells. The shell loses this colouration just before the formation of the outer lip.

Synonymy.

1771 *Strombus minimus* Linné, p. 549. Gmelin 1791, p. 3516, no. 23, partly. Dillwyn 1817, p. 670. Swainson 1829, pl. 10. Sowerby 1842, pl. 6, fig. 4 and 5. Duclos in Chenu 1844, pl. 10, figs. 1 and 2. Reeve 1851, pl. 18, fig. 47. Hanley 1856, p. 124, pl. 25, fig. 26. Tryon 1885, p. 117, pl. 6, fig. 62. Dodge 1956, p. 298. Hinton 1972, p. 10, pl. 5, figs. 25 and 26. Dance 1974, p. 84. Hinton 1977b, p. 10, fig. 9. Abbott and Dance 1982, p. 79. = *Lambis minimus* Gmelin – Röding 1798, p. 65, no. 836 and 837. = *Strombus (Dolomena) minimus* Linné – Abbott 1960, p. 105, pl. 18, figs. 4 and 5, pl. 74, fig. 3, pl. 81. Cernohorsky 1965, p. 8, pl. 2, fig. 11. Cernohorsky 1972, p. 79, pl. 19, fig. 6. Springsteen and Leobrera 1986, p. 72, pl. 17, fig. 9. Kreipl *et al.* 1999, pp. 12 and 41, pl. 82, figs. 1 – 4. Okutani 2000, p. 183, pl. 91, fig. 19. = *Strombus (Labiostrombus) minimus* Linné – Willan 2000, p. 19. = *Dolomena minima* Linné – Liverani 2014, p. 36, pl. 82, figs. 1 – 4.

1822 *Strombus troglodytes* Lamarck, p. 209 – Kiener 1843, p. 52, pl. 21, fig. 2. Reeve 1860, p. 94. Tryon 1885, pp. 117 and 146, pl. 6, fig. 62.

Distribution. Literary Records – *Fiji* (Cernohorsky 1965); Manava Island (Cernohorsky 1972); Rukua, Bega Island ('Thaanum' in Abbott 1960); Suva Point, Viti Levu Island (Abbott 1960). *Indonesia* (Cernohorsky 1965); Ambonia (Abbott 1960); Banka Island (Abbott 1960); Celebes (Abbott 1960); Dauwi Island, east Padaido Islands (Abbott 1960); Flores (Abbott 1960); Loloda (Abbott 1960); Riau [Riau?] Islands (Abbott 1960); Timor (Abbott 1960). *Japan* Buckner Bay (Abbott 1960); Ryukyu Islands (Cernohorsky 1965). *New Caledonia* Touho Bay (Abbott 1960); South West Lagoon (Richer de Forges *et al.* 1988). *Papua New Guinea* Finschhafen (Abbott 1960); Samarai Bay (Abbott 1960); Oro Bay (Abbott 1960); Seleo island, Aitape Island (Abbott 1960); Rabaul, New Brittan (Abbott 1960; Hinton 1972). *Philippines* (Cernohorsky 1965); Camiguin Island (Abbott 1960); Cebu Island (Abbott 1960); Luzon Island (Abbott 1960); Marinduque Islands (Abbott 1960); Mindoro (Abbott 1960); Negros Island (Abbott 1960); Palawan Island (Abbott 1960); Panay Island (Abbott 1960). *Solomon Islands* Guadalcanal Island (Abbott 1960). *Taiwan* Taihoku-syu ('Kuroda' in Abbott 1960). *Vanuatu* Espiritu Santo Island (Abbott 1960). Material Examined – *Australia* Dingo Beach (SMC x 1; VC x 1; YC x 1). *Fiji* Rovondrau Bay, Suva (SMC x 1). *Indonesia* Sumberkima, Bali Island (SMC x 36). *New Caledonia* (SMC x 2). *Papua New Guinea* Kokopo (SMC x 1); Korere, Rabaul (SMC x 1); Port Moresby (SMC x 1); Rabaul (SMC x 13; YC x 1). *Philippines* Balicasag Island (SMC x 1); Cebu Island (SMC x 1); Negros Island (YC x 1). *Solomon Islands* Ghiza Harbour (SMC x 4); Guadalcanal Island (SMC x 5); Ngella Island (SMC x 1). *Vanuatu* (SMC x 2; YC x 7).

Ministrombus variabilis (Swainson, 1820)
(Figures 8 – 10)

Type. Image of lectotype – Swainson 1820, p. 10 (Figure 1).

Type Location. Cebu Island, Philippines (Abbott 1960).

Original Description. "Shell with nodulous spire not striated. Inner lip simple. Outer lip reflected, smooth within and slightly lobed above" (Swainson 1820).

Supplementary Diagnosis.

The shell is moderately sized bipyramidal. When viewed axially the early whorls are round but the shell becomes dorsoventrally compressed on the last whorl, with the ventral side appearing flat, giving the shell a moderately triangulate appearance. Early whorls are rounded and smooth with fine microscopic striations. The spire has a well-defined subsutural chord. Later whorls form a moderately angulate shoulder that continue onto the ventral body whorl. The mid-spire whorls with wide axial plaits varying in strength and may be highly diminished in some specimens. On the mid-spire the striations are variable within populations, where some individuals may be strongly striated and others without any striations. Later whorls become smooth in all specimens. The white columella is weaker posteriorly, anteriorly it tends to thicken and there is a smooth transition to the anterior canal. There is often a large dark stain in the centre of the columella. The outer lip is smooth and uniformly calloused in the midsection, while the top of the aperture is stepped and thin forming a shallow wide lobe the width of the aperture. The outer lip joins the shell somewhere between the two shoulders of the final and penultimate whorl. The stromboidean notch is wide and moderately developed. The stromboidean lobe is well developed. The anterior of the shell is somewhat constricted and elongated, and may be axially reflected to a degree, but this is

highly variable within populations. The colouration is highly variable, being typically maculated. There are thin fine axial lines. The pattern is typically interrupted by five white bands.

Synonymy.

1820 *Strombus variabilis* Swainson, p. 10. Kiener 1843, p. 49, pl. 21, fig. 2. Sowerby 1842, pl. 6, fig. 9. Duclos in Chenu 1844, pl. 11, figs. 9 and 10; Hanley 1856, p. 216, pl. 4, fig. 18. Reeve 1850, pl. 10, figs. 21c and d; Reeve 1860, p. 94. Tryon 1885, p. 117, pl. 6, fig. 59. Allan 1950, p. 100, pl. 17, fig. 14. Hinton 1972, p. 10, pl. 5, fig. 5. Dance 1974, p. 86. Hinton 1977a, p. 9, fig. 5. Hinton 1977b, p. 9, fig. 5. Abbott and Dance 1982, p. 79. = *Strombus (Gallinula) variabilis* Swainson - Tryon 1885, pp. 117 and 146, pl. 6, figs. 59 and 60. = *Strombus (Dolomena) variabilis* Swainson - Abbott 1960, p. 103, pl. 4, figs. 21 and 22, pl. 79, figs. 1 and 2. Springsteen and Leobrera 1986, p. 72, pl. 17, figs. 8a - c. Okutani 2000, p. 183, pl. 91, fig. 18. = *Strombus (Dolomena) variabilis variabilis* Swainson - Kreipl *et al.* 1999, p. 45, pl. 91, figs. 1, 2 and 4 - 7. = *Strombus (Labiostrombus) variabilis* Swainson - Willan 2000, p. 19. = *Dolomena variabilis* Swainson - Kronenberg 2008, pl. 225, figs. 1 - 3. = *Dolomena variabilis variabilis* Swainson - Brown 2011, p. 248. Liverani 2014, p. 36, pl. 149, fig. 4, pl. 150, fig. 1 and 2.

1829 *Strombus lituratus* Menke, p. 58, no. 1205.

Distribution. Literary Records - *Indonesia* Bouro Island, Molluccas (Abbott 1960); Woda Island, Halmahera (Abbott 1960). *Philippines* Balabac Island (Abbott 1960); Bantayan Island (Abbott 1960; Kronenberg 2008); Cebu City, Cebu Island (Abbott 1960); Cuyo Island (Abbott 1960); Legaspi Bay, Luzon Island (Abbott 1960); Olango Island (Kronenberg 2008); Samar (Kronenberg 2008); San Jose,

Mindoro Island (Abbott 1960); Sanga-Sanga Island (Abbott 1960); Tabaco, Luzon Island (Abbott 1960); Tilik Bay, Lubang Island (Abbott 1960); Zamboanga, Mindanao Island (Abbott 1960). *Singapore* (Abbott 1960). *Thailand* Ban Pe, Rayong (Abbott 1960); Koh Chang (Abbott 1960); Koh Samet (Abbott 1960). Material Examined - *Indonesia* Bangka Island (SMC x 1); Raas, Kangean Island (SMC x 82); Kangean Island (SMC x 1; VC x 3); Sakala Island, Kangean Islands (SMC x 1); Singaraja, West Bali (SMC x 3). *Philippines* Aliguay Island (SMC x 1); Balicasag Island (SMC x 5); Banacon (SMC x 1; VC x 3); Bohol (SMC x 2; VC x 1); Cebu (SMC x 4; VC x 5); Dinagat Island (SMC x 3); Don Paulino (SMC x 1); Mactan Island (YC x 1); Negros (SMC x 1); Nocnocan Island (SMC x 2; YC x 4); Olango Island (YC x 1; VC x 1); Palawan (VC x 2); Virgin Island, Bantayan (SMC x 15). *Vietnam* Nha Trang (SMC x 1).

Ministrombus aurantius Maxwell, n. sp.
(Figure 11)

Type. Holotype - Kangean Islands, Indonesia, 2021, 37.8 mm (SBRF TCMOL0002). Paratype 1 - Gaya Island, Saha, Malaysia, 2010, 33.2 mm (SMC53.011b); B) Paratype 2 - Gaya Island, Saha, Malaysia, 2010, 31.5 mm (SMC53.011a); C) Paratype 3 - Kangean Islands, Indonesia, 2021, 32.5 mm (SMC53.003a); D) Paratype 4 - Kangean Islands, Indonesia, 2021, 34.2 mm (SMC53.003c); E) Paratype 4 - Indonesia, 33.9 mm (SMC53.002).

Type Location. I designate Kangean Islands, Indonesia as the type location.

Diagnosis. Shell rounded with distinctive orange solid bands and well-rounded shoulder with weak nodulations.

Description. The shell is small, ovate and round when viewed axially. Early whorls are rounded developing very weak shoulder nodules on later

whorls that reach the suture below the shoulder. There is a moderate sutural ramp that is smooth. The nodulation on the penultimate whorl varies from nodulous to being smooth. The ventral body whorl is rounded with a distinctive axial fold. The dorsum is smooth with a few small blunt knobs. The anterior striations are faint and may be diminished to absent. The columella is well developed, white and thickened anteriorly. The aperture is white with a wide posterior lobe and joins the shell at or just above the shoulder. The posterior sinus is short and weakly calloused. The stromboidean notch is deep, and the stromboidean lobe is extended and squarish. The colour is white, with bands that vary in intensity from dark brown to orange-red to yellow, and in rare specimens form a block colour on the dorsum.

Synonymy.

Strombus (Dolomena) variabilis athenius Duclos – Kreipl *et al.* 1999, p. 45, pl. 92, figs. 1 and 2. = *Dolomena variabilis athenia* Duclos in Chenu – Liverani 2014, p. 36, pl. 149, fig. 3.

1974 *Strombus (Dolomena) variabilis palauensis* Romagna-Manoja, p. 13.

Etymology. The name reflects the Latin for orange stripes indicative of the species: *aurantiaco* – orange.

Distribution. Literary Records – Biak Island, Dutch New Guinea (Abbott 1960). *Palau* (Cernohorsky 1965). Material Examined – *Indonesia* (SMC x1); Kangean Island (SMC x 3). *Malaysia* Gaya Island, Sabah (SMC x 2; VC x 1). *Philippines* (VLC x 12); Mactan Island (VC x 1); Negros Island (YC x 1). *Solomon Islands* (VC x 2); Honiara, Guadalcanal (VLC x 3). *Papua New Guinea* Kavieng Porebada (VC x 2); Kavieng (VLC x 8); Manus Island (VLC x 3); Rabaul (VC x 1). *Samoa* ?(VLC x 2).

Ministrombus caledonicus Maxwell, n. sp.
(Figure 12)

Type. Holotype – Arama, New Caledonia, 1976, 37.8 mm (SBRF TCMOL0003). Paratype 1 – South Poum, New Caledonia, 2018, 28.8 mm (SMC52c.007d); Paratype 2 – South Poum, New Caledonia, 2018, 38.3 mm (SMC52c.007a); Paratype 3 – New Caledonia, 1976, 37.6 mm (SMC52c.005a); Paratype 4 – New Caledonia, 1976, 38.2 mm (SMC52c.005d); and Paratype 5 – New Caledonia, 1976, 42.6 mm (SMC52c.005c).

Type Location. I designate Arama, New Caledonia as the type location.

Diagnosis. The shell is moderately solid and heavy for size and ovately fusiform with a straight columella.

Description. The shell is ovately fusiform and moderately elongated. Spire whorls are rounded and slightly angulate at the shoulder. Early whorls are smooth, with faint to diminished spiral striations. The shoulder of the later spiral whorls develop nodulations that may be diminished by the penultimate whorl in some specimens. The subsutural ramp varies in development and may be absent in some specimens. The columella is weak and may be anteriorly coloured at the end. There may be a small brown blotch on the middle of the columella. The outer lip is moderately calloused and thickened and the aperture is open. The outer lip may have dark colouration in part in some specimens, and anteriorly this may also form a band of colour along the edge of the lip. The posterior sinus is shallow, short and not calloused. The body whorl is smooth and the shoulder is moderately angulate, with a few shoulder nodules that are slightly axially elongated. The colour is variable with bands ranging dark to light brown, occasionally with maculations.

Synonymy.

Strombus variabilis Swainson – Tryon 1885, p. 117, pl. 6, fig. 60. Hinton 1972, p. 10, pl. 5, fig. 4. Hinton 1977, p. 9, fig. 5a. = *Strombus (Dolomena) varaibilis* Swainson – Walls 1980, pp. 123 and 124. = *Dolomena variabilis variabilis* Swainson – Liverani 2014, p. 36, pl. 150, fig. 3.

Strombus (Dolomena) variabilis athenius

Duclos – Abbott 1960, p. 104, pl. 4, fig. 20, pl. 79. figs. 3 and 4. Kreipl *et al.* 1999, p. 45, pl. 92, figs. 3 and 4. = *Strombus (Dolomena) variabilis variabilis* form *athenius* Duclos in Chenu – Cernohorsky 1965, p. 8, pl. 3, fig. 14. Ladd 1972, p. 59, pl. 18, figs. 1 and 2. Cernohorsky 1972, p. 79, pl. 18, fig. 11. = *Dolomena variabilis athenia* Duclos in Chenu – Liverani 2014, p. 36, pl. 149, figs. 1 and 2, pl. 150, fig. 3.

Etymology. The name is drawn from the Latin and reflects the locality: Caledonia - Location.

Distribution. Literary Records – *Fiji* (Cernohorsky 1965); Suva (Abbott 1960). *New Caledonia* Anse Vata (Cernohorsky 1965); barrier reef, Touho Bay (Abbott 1960); Bourail (Cernohorsky 1972); Laregnere Reef, east of Noumea (Abbott 1960); Noumea (Abbott 1960); South West Lagoon (Richer de Forges *et al.* 1988). *Papua New Guinea* ?Porabada (Hinton 1972). Material Examined – *Fiji* (VC x 1); *New Caledonia* (SMC x 4); Arama (SMC x 1); Balabic Island (YC x 1); Beleps Islands (VC x 2); ?Plage de Baffade (SMC x 1); South Poum (SMC x 6). *Tonga* (VC x 1).

Ministrombus oceanicus Maxwell n. sp.
(Figure 13)

Type. Holotype – Kwajalein, Marshall Islands, 2011, 32.4 mm (SBRF TCMOL0004). Paratype 1 – Kwajalein, Marshall Islands, 2011, 39.0 mm (SMC52b.001c); Paratype 2 – Kwajalein, Marshall Islands, 2011, 26.9 mm (SMC52b.001f); Paratype 3 – Kwajalein,

Marshall Islands, 2011, 34.9 mm (SMC52b.001b); Paratype 4 – Kwajalein, Marshall Islands, 2011, 46.6 mm (SMC52b.001a); and Paratype 5 – Kwajalein, Marshall Islands, 2011, 30.8 mm (SMC52b.001d).

Type Location. I designate Kwajalein, Marshall Islands as the type locality.

Diagnosis. The shell is heavy, small and typically white with maculation, and shoulders that are rounded with blunt nodulations that typically continue onto the dorsum of the body whorl.

Diagnosis. The shell is small, heavy and solid. All the whorls rounded when viewed axially. The shoulders of the whorls are rounded and not elevated, with small low pointed nodules that are axially elongated reaching the suture in most cases and well forms on all whorls. The first whorls of the spire have microscopic fine striae which are often diminished, there are no spiral striations on later whorls. The suture of upper whorls is just below the shoulder with a fine subsutural band before the shoulder rises. The columella is smooth and calloused, being thicker and broader toward the base of the shell. The stromboidean notch is well formed and deep, and the stromboidean lobe is well defined. The anterior of the shell may have very fine highly diminished incised lines. The outer lip is thickened, calloused and rounded. The aperture is uniform with a thin wide posterior lobe that joins the outer lip to the shell. The outer lip joins at or just above the shoulder of the last whorl. The posterior sinus is moderately developed and is lobed both sides. The columella is white, and there may be a dark blotch in the middle. There is a strong ventral shoulder fold, and the shoulder is nodulated. This nodulation is variable in strength and typically carries onto the dorsum on the body whorl. The colour of the shell is white with six bands of brown to tan maculations. There is no very fine axial colouration.

Synonymy.

Strombus variabilis Swainson – Sowerby 1842, pl. 6, figs. 13 and 14. Kiener 1843, pl. 21, fig. 2a. Reeve 1850, pl. 10, figs. 21a and b.

Etymology. Named for its isolated oceanic environments: ocean - *oceanicus*

Distribution. Literary Records – *Kiribati* Gilbert Islands (Thomas 2002). *Marshall Islands* (Cernohorsky 1965); *Arno Lagoon* (Abbott 1960); *Bikini Atoll* (Abbott 1960); *Kwajalein* (Abbott 1960); *Majuro Atoll* (Abbott 1960); *Rongelap Atoll* (Abbott 1960). *Micronesia* Truk Island ('Gallemore' in Abbott 1960). Material Examined – Kwajalein (SMC x 6).

Comparative Remarks

Ministrombus minimus is readily discerned from other member of the genus by its dorso-ventral compression, giving it a planar appearance when viewed axially. The lobes of the anterior sinus in *M. minimus* are extended and heavily calloused. The largest and most morphologically variable of the *Ministrombus* is *M. variabilis*. However, despite its plasticity in form, *M. variabilis* is larger, more elongated, and a heavier member of the genus than its sister species. While all members of *Ministrombus* have rounded early whorls, *M. variabilis* typically is more triangulate in its final growth stage. Similar in form to *M. variabilis*, *M. athenius* can be distinguished by its more rotund shell, lighter weight and being not as axially extended as *M. variabilis*. *Ministrombus oceanicus* is a small heavy species whose ovate shell is thickened, the anterior of the columella is heavily calloused, and the body whorl is nodulose at the shoulder. This is in contrast the *M. aurantius*, a species which is lighter and when present with greatly reduced shoulder nodules. It has a columella that it is not heavily calloused anteriorly. While similar in form to

M. aurantius, *M. caledonicus* differs in being a heavier more robust shell with a shoulder on the whorls that is more angulate, often has much stronger nodulation, and apertural colouration.

DISCUSSION

Abbott (1960) noted that there was a lack of material at his disposal to gain a full understanding of the *Ministrombus* complex. What was clear to that author was the difference between the Philippine shells and those of the central and southern Pacific. Abbott (1960) assigned the name of *M. athenius* to the orange banded shell that is herein named *M. aurantius*. With the discovery and publishing of the other syntypes [now paralectotypes given Abbott (1960) declared the lectotype] in the Duclos collection, a more authoritative understanding of *M. athenius* can be made, and this is reflected in the taxonomy herein where it is recircumscribed to encapsulate the specimens from Queensland, and a new type locality declared. Abbott (1960) also alluded to a darker shell from New Caledonia and Solomon Islands. These observations of this author are reflected in the new species *M. caledonicus*.

CONCLUSION

This iconography illustrates a total of six *Ministrombus*, which includes 3 new species all of which have distinct morphology and most have a discrete biogeographical zonation. The recircumscription of *M. athenius*, and the shift in type location, is reflective of the type material, and this amended the attribution of Abbott (1960) enabling the recognition of *M. aurantius*. This work further adds to the growing body of recent revisions in the Strombidae and provides greater clarity of the species and their unique distributions that are contained within this complex of most beautiful marine snails.

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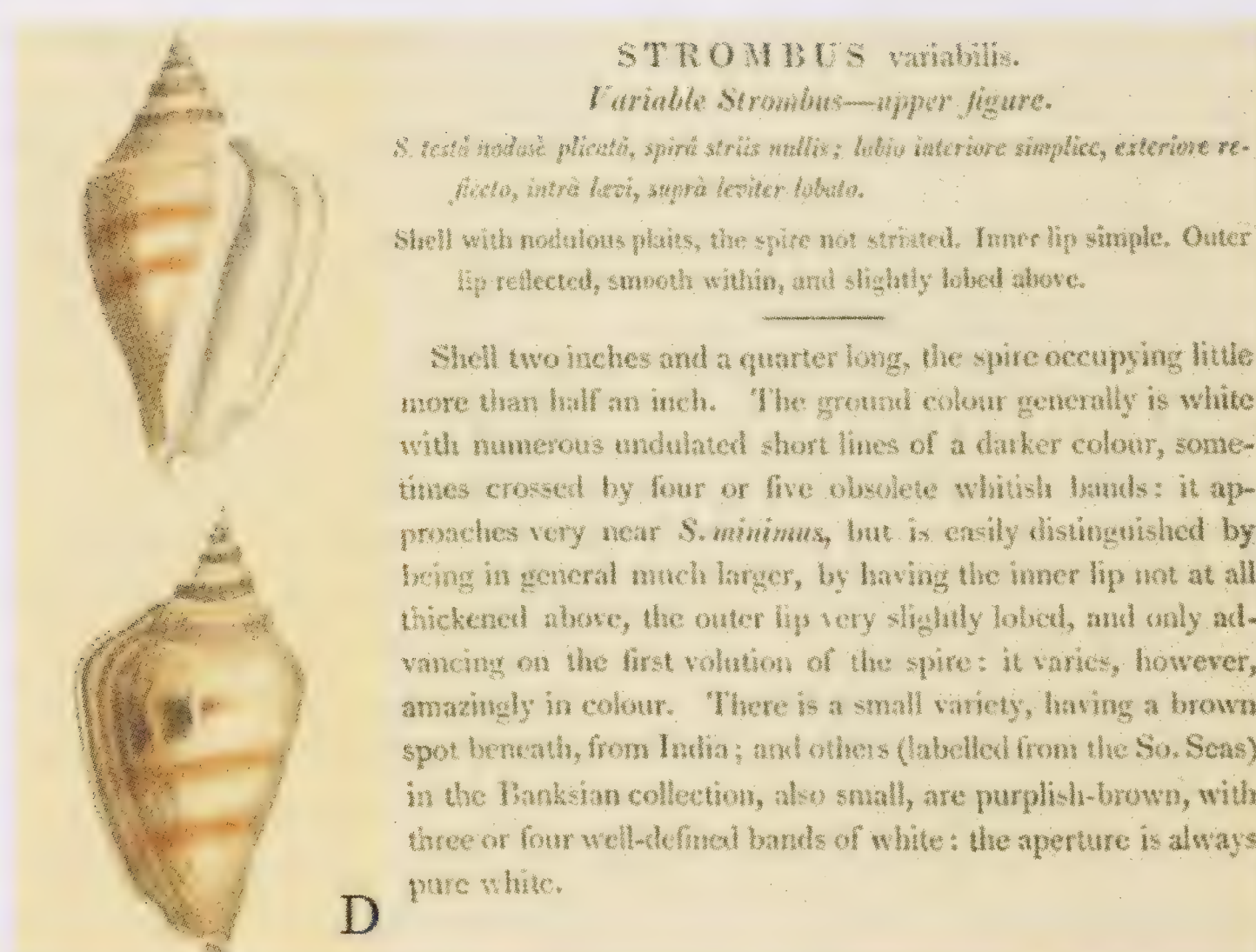
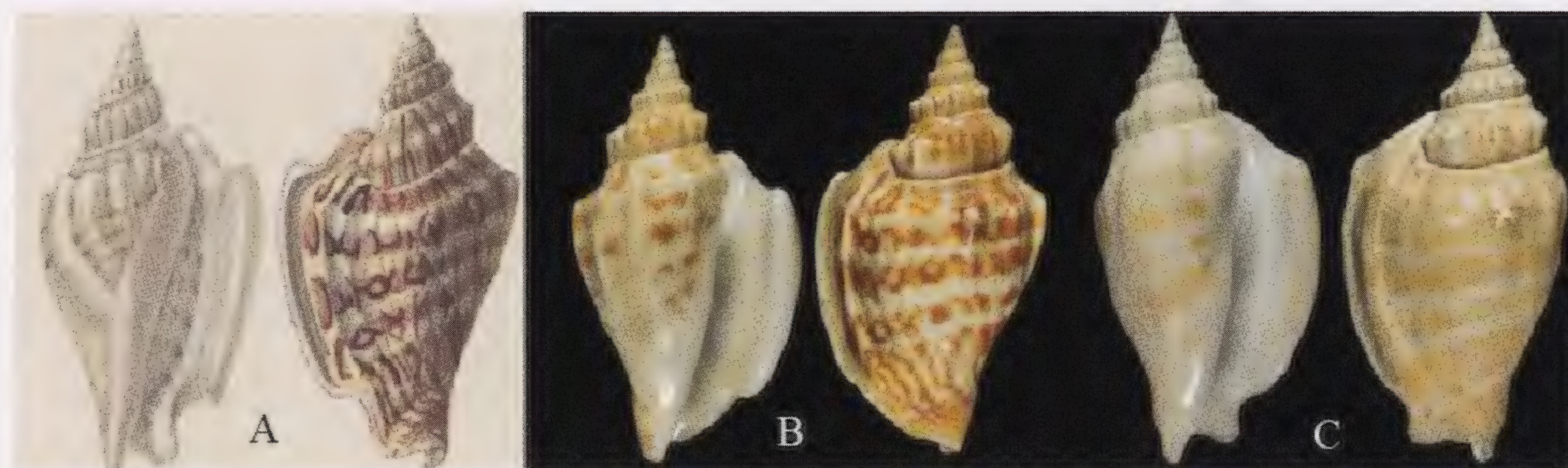
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DOI:10.54173/F542116



minimus STROMBUS testæ labro retuso gibbo, ventre spiraque plicato-nodoso, apertura bi-labiata lævi.
Rumph. mus. t. 36. f. P. Epidromis minima.
Habitat in India orientali.
Testa Simillima ST. urceæ, sed minor. Dorsum testaceum. Faux lævis, flava, nec striata. Labium utrumque albidum.



Figure 1. Images of the types of described *Ministrombus*. *Ministrombus athenius* (Duclos, 1844) – A= the image of the lectotype Duclos (1844) pl. 11, fig. 2 (ventral), and the corresponding dorsal image, pl. 11 fig. 1; and B, C= the two paralectotypes held in the Muséum National D'Histoire Naturelle Paris (MNHN-IM-2000-32907). *Ministrombus variabilis* (Swainson, 1820) – D= The image of the lectotype of *Strombus variabilis* Swainson, 1820, p. 10. *Ministrombus minimus* (Linné, 1771) – E= The Linné (1771, p. 549) text and the image of the holotype (Rumphius 1705, 1741, pl. 36, fig. P).

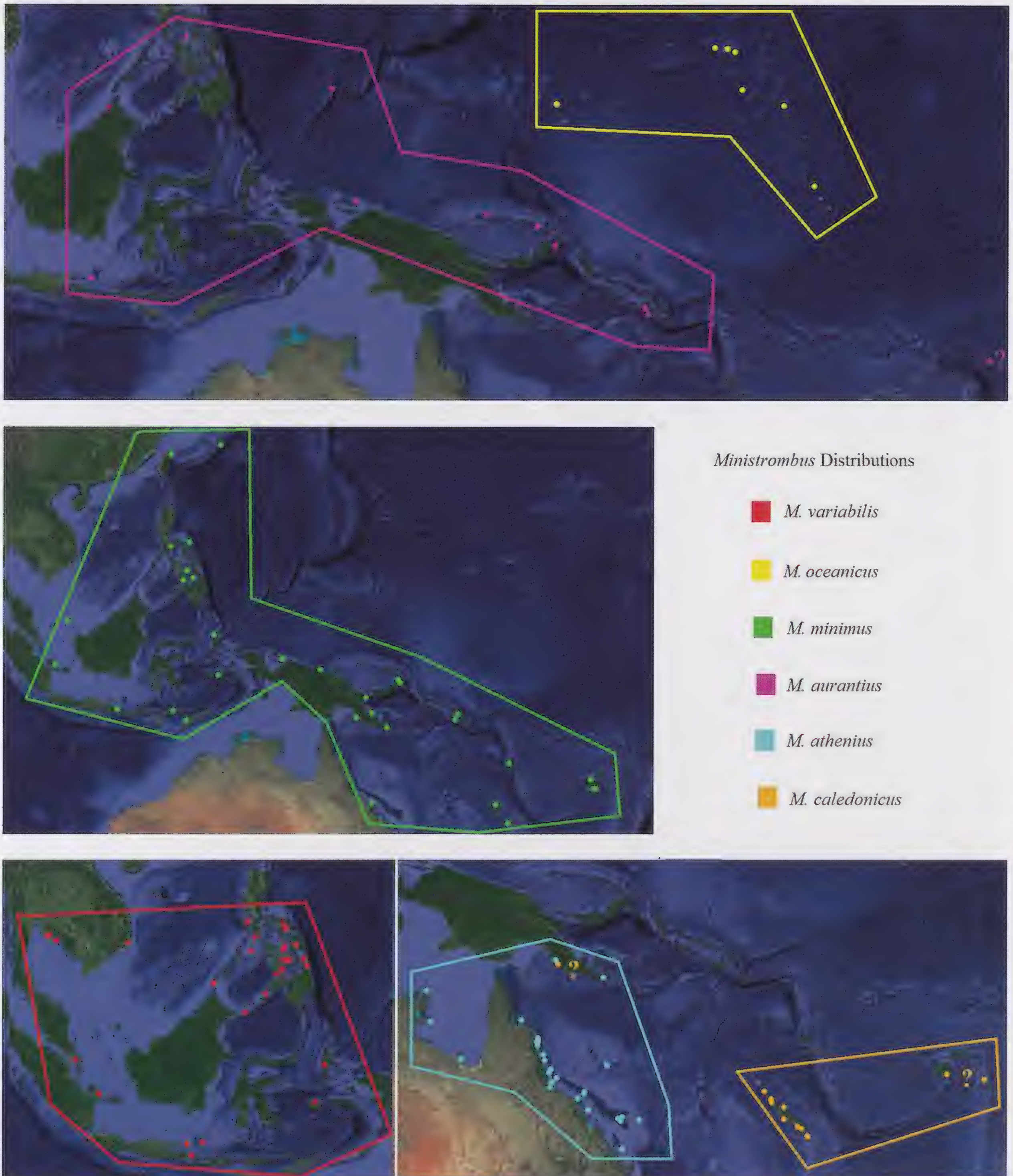


Figure 2. The estimated distribution of species contained within *Ministrombus* based on available data.

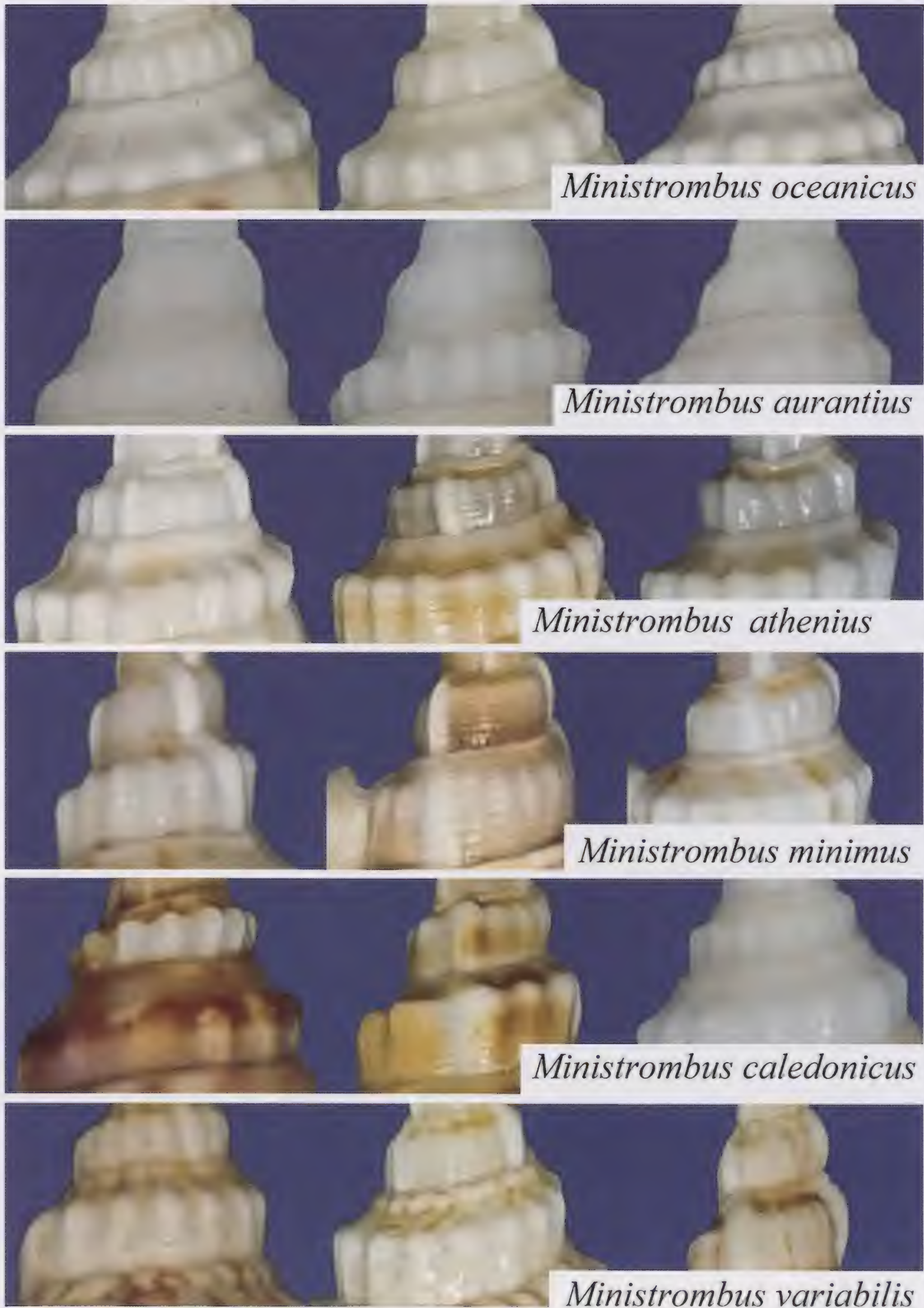


Figure 3. The mid-spire of members of *Ministrombus* showing the inter- and intra-specific variability.



Figure 4. *Ministrombus athenius* (Duclos, 1844): **A**= Perfect Reef, Swains Reefs, Queensland, 2002, 47.0 mm (SMC52a.006f); **B**= Green Island, Queensland, 2021, 39.1 mm (SMC52a.026b); **C**= Cairns Reef, Queensland, 1981, 43.3 mm (SMC52a.020); **D**= Kurrimine Beach, Queensland, 40.2 mm (SMC52a.023b); **E**= Dingo Beach, Queensland, 1984, 39.3 mm (SMC52a.0); **F**) Yamacutter Reef, Queensland, 2018, 37.2 mm (SMC52a.019).



Figure 5. *Ministrombus athenius* (Duclos, 1844): **A**= Big Sandy, Swains Reefs, Queensland, 1999, 44.5 mm (SMC52a.002b); **B**= Big Sandy, Swains Reefs, Queensland, 1999, 39.9 mm (SMC52a.002a); **C**= Undine Reef, Queensland, 2009, 42.0 mm (SMC52a.022b); **D**= Milne Bay, Papua New Guinea, 1990, 48.2 mm (SMC52a.012b); **E**= Dingo Beach, Queensland, 1992, 47.6 mm (SMC52a.003b); and **F**= Trunk Reef, Queensland, 2003, 37.1 mm (SMC52a.008a).

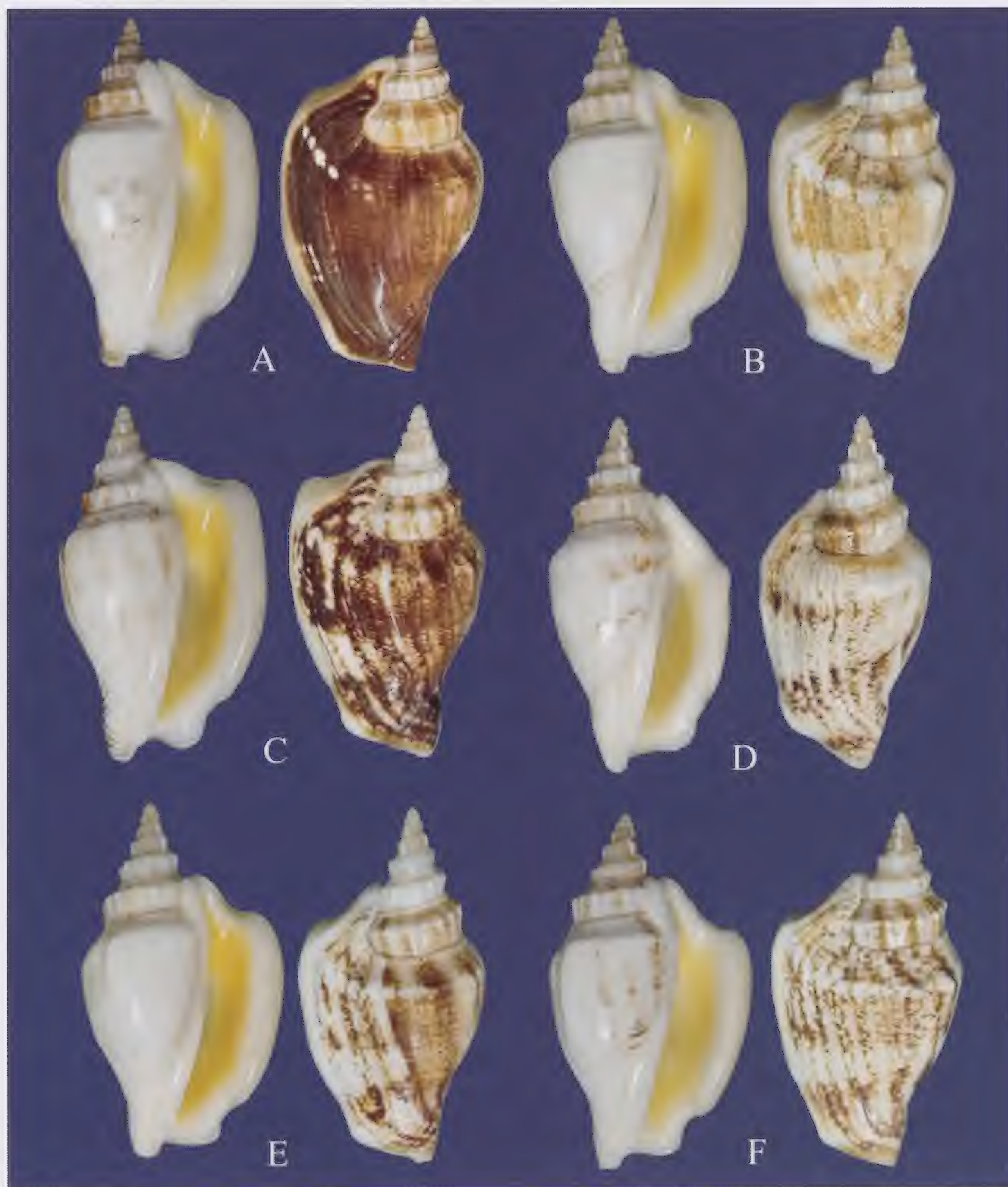


Figure 6. *Ministrombus minimus* (Linné, 1771): **A**= Sumber Kima, Bali Island, Indonesia, 2020, 33.1 mm (SMC58.009w); **B**= Sumber Kima, Bali Island, Indonesia, 2020, 31.4 mm (SMC58.009b); **C**= Sumber Kima, Bali Island, Indonesia, 2020, 31.9 mm (SMC58.009e); **D**= Sumber Kima, Bali Island, Indonesia, 2020, 33.0 mm (SMC58.009y); **E**= Sumber Kima, Bali Island, Indonesia, 2020, 31.6 mm (SMC58.009l); and **F**= Sumber Kima, Bali Island, Indonesia, 2020, 36.5 mm (SMC58.009u).

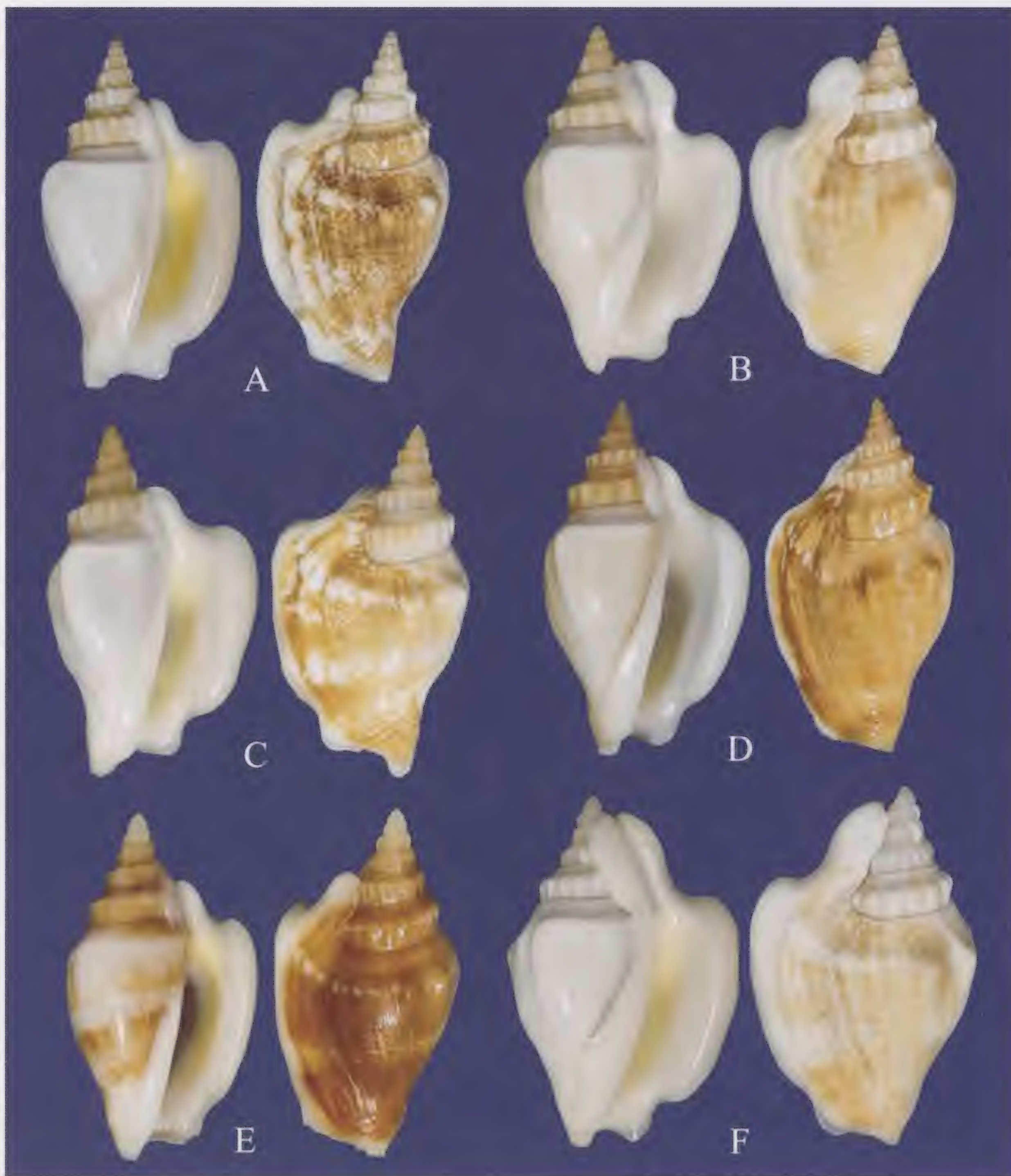


Figure 7. *Ministrombus minimus* (Linné, 1771): **A)** Balicasag Island, Philippines, 2015, 32.9 mm (SMC58.008); **B)** Guadalcanal, Solomon Islands, 2014, 21.2 mm (SMC58.006b); **C)** Vanuatu, 2014, 22.4 mm (SMC58.003b); **D)** Rovandrau Bay, Suva, Fiji, 1978, 32.8 mm (SMC58.012); **E)** Rabaul, Papua New Guinea, 2008, 22.5 mm (SMC58.004g); and **F)** Rabaul, Papua New Guinea, 2008, 22.7 mm (SMC58.004e).

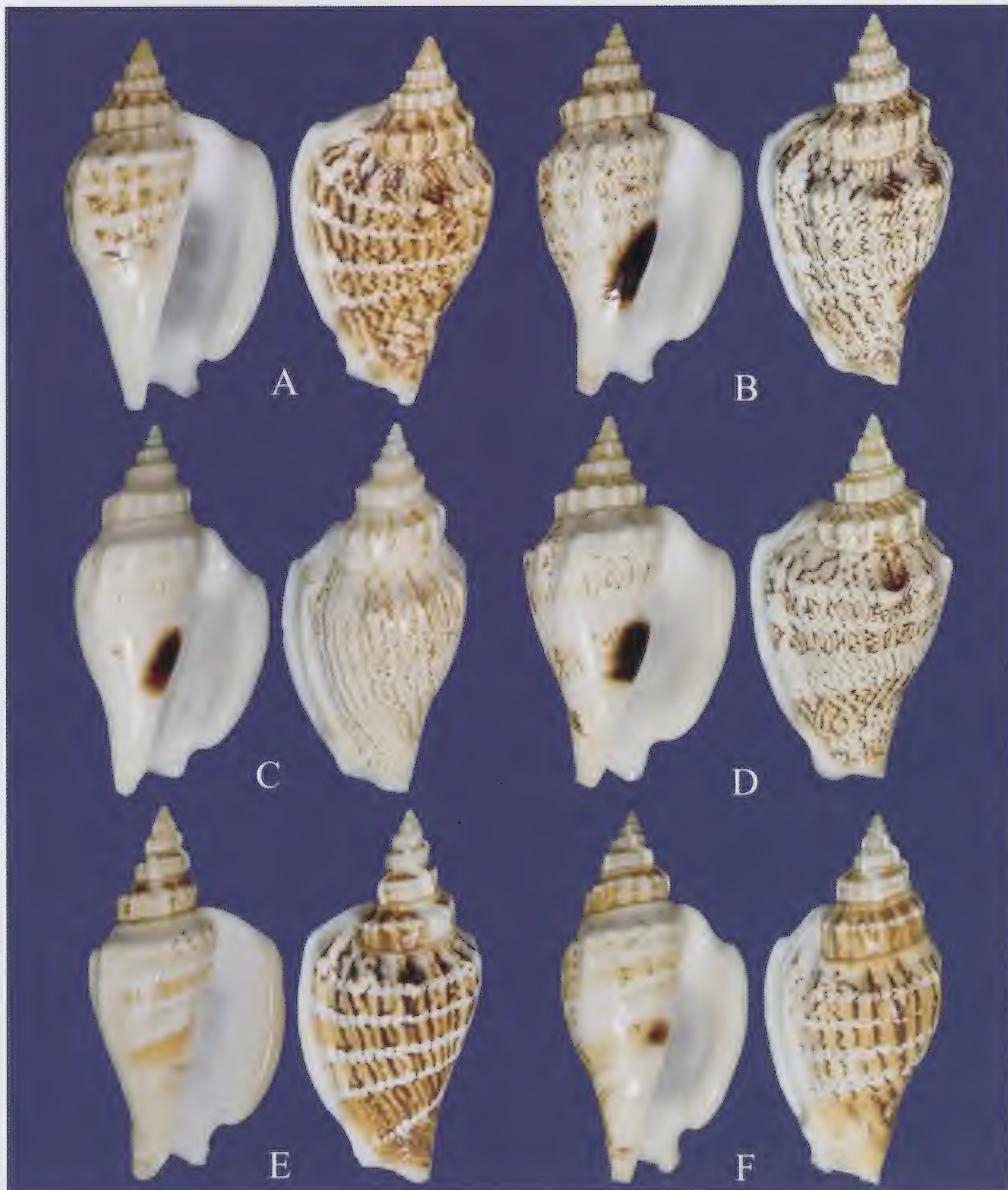


Figure 8. *Ministrombus variabilis* (Swainson, 1820): **A)** Balicasag Island, Philippines, 2019, 36.5 mm (SMC52.009e); **B)** North Bohol, Philippines, 2019, 53.66 mm (SMC52.007b); **C)** Cebu Island, Philippines, 1970, 53.22 mm (SMC52.017b); **D)** Banacon, Philippines, 2019, 46.3 mm (SMC52.010m); **E)** Negros Island, Philippines, 2019, 57.6 mm (SMC52.004); and **F)** Dinagat Island, Philippines, 2009, 55.6 mm (SMC52.002c).



Figure 9. *Ministrombus variabilis* (Swainson, 1820): **A**= Cebu Island, Philippines, 2019, 56.9 mm (SMC52.011); **B**= Dinagat Island, Philippines, 2009, 56.8 mm (SMC52.002b); **C**= Nocnocan Island, Philippines, 2019, 51.4 mm (SMC52.005b); **D**= Balicasag Island, Philippines, 2019, 35.2 mm (SMC52.009a); **E**= Banacon, Philippines, 2019, 40.9 mm (SMC52.010d); **F**= Virgin Island, Bantayan, Philippines, 2019, 64.6 mm (SMC52.006b).

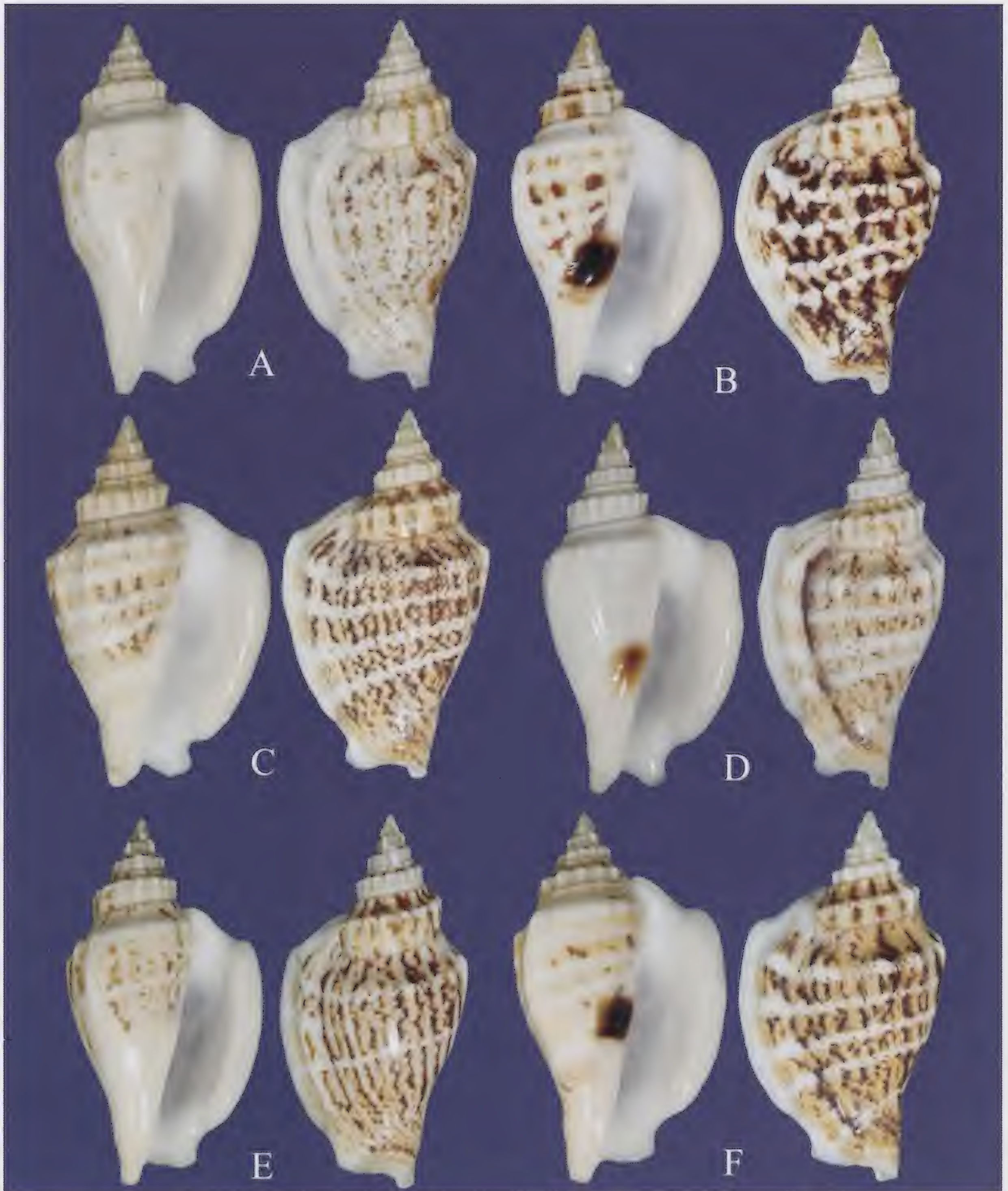


Figure 10. *Ministrombus variabilis* (Swainson, 1820): **A**= Raas, Kangean Islands, Indonesia, 2021, 43.3 mm (SMC52.016aj); **B**= Raas, Kangean Islands, Indonesia, 2021, 39.6 mm (SMC52.016f); **C**= Raas, Kangean Islands, Indonesia, 2021, 39.4 mm (SMC52.016au); **D**= Raas, Kangean Islands, Indonesia, 2021, 42.0 mm (SMC52.016m); **E**= Raas, Kangean Islands, Indonesia, 2021, 48.0 mm (SMC52.016e); and **F**= Raas, Kangean Islands, Indonesia, 2021, 39.3 mm (SMC52.016l).

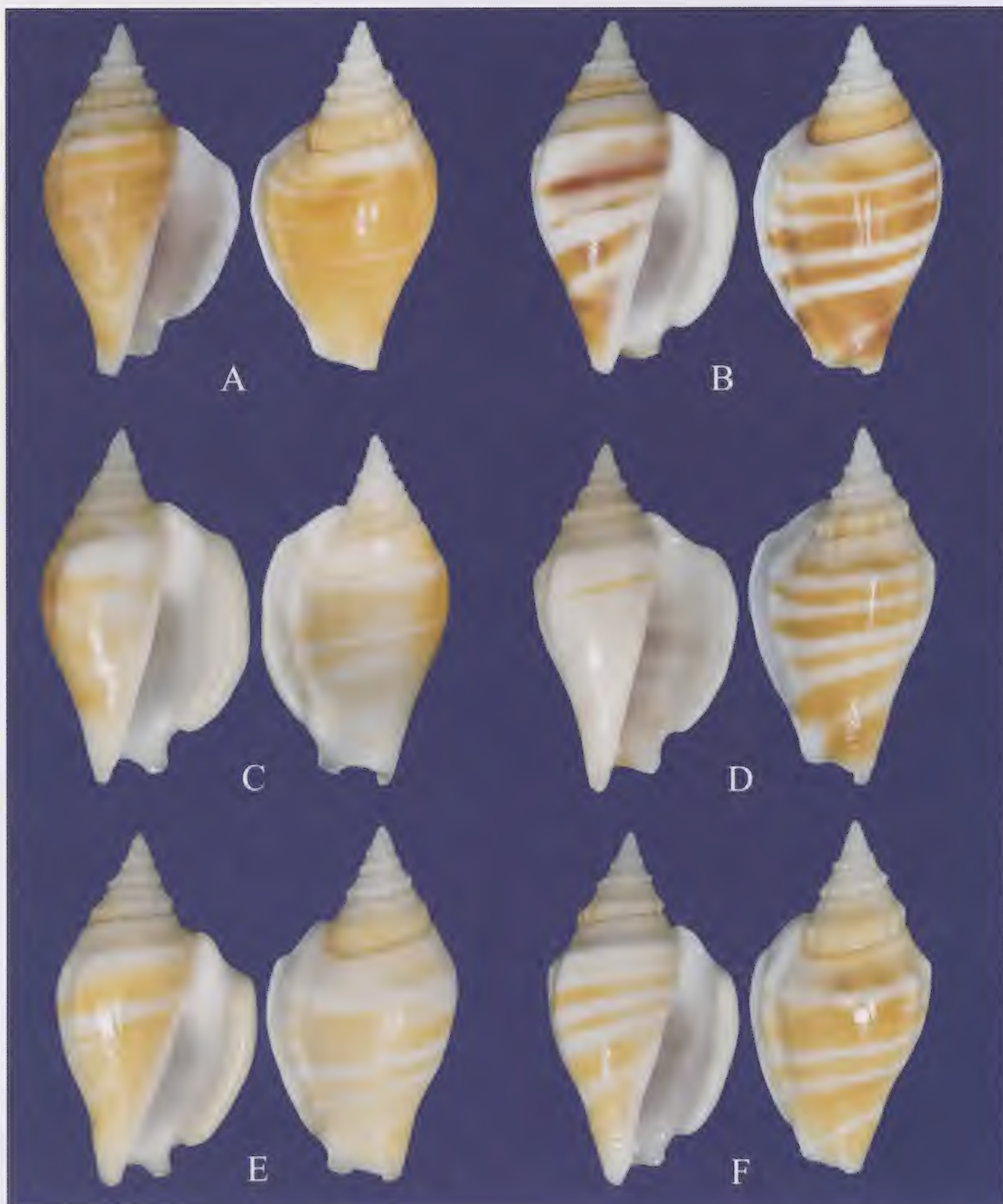


Figure 11. *Ministrombus aurantius* nov. sp. : **A**= Paratype 1 – Gaya Island, Saha, Malaysia, 2010, 33.2 mm (SMC53.011b); **B**= Paratype 2 – Gaya Island, Saha, Malaysia, 2010, 31.5 mm (SMC53.011a); **C**= Paratype 3 – Kangean Islands, Indonesia, 2021, 32.5 mm (SMC53.003a); **D**= Paratype 4 – Kangean Islands, Indonesia, 2021, 34.2 mm (SMC53.003c); **E**= Paratype 4 – Indonesia, 33.9 mm (SMC53.002); and **F**= Holotype - Kangean Islands, Indonesia, 2021, 37.8 mm (SBRF TCMOL0002).



Figure 12. *Ministrombus caledonicus* nov. sp.: **A**= Paratype 1 – South Poupou, New Caledonia, 2018, 28.8 mm (SMC52c.007d); **B**= Paratype 2 – South Poupou, New Caledonia, 2018, 38.3 mm (SMC52c.007a); **C**= Paratype 3 – New Caledonia, 1976, 37.6 mm (SMC52c.005a); **D**= Paratype 4 – New Caledonia, 1976, 38.2 mm (SMC52c.005d); **E**= Holotype – Arama, New Caledonia, 1976, 37.8 mm (SBRF TCMOL0003); and **F**= Paratype 5 – New Caledonia, 1976, 42.6 mm (SMC52c.005c).

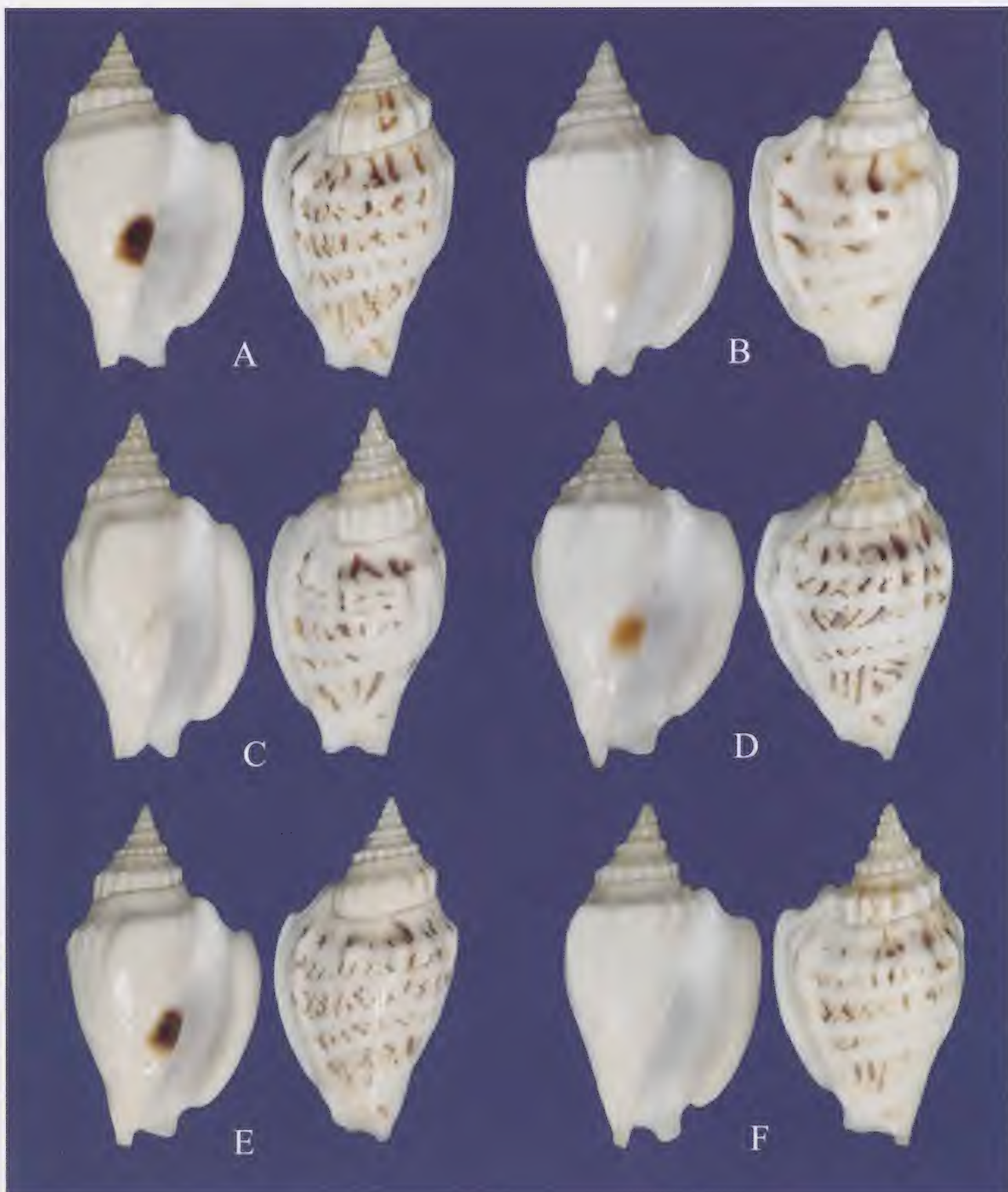


Figure 13. *Ministrombus oceanicus* nov. sp.: **A**= Paratype 1 – Kwajalein, Marshall Islands, 2011, 39.0 mm (SMC52b.001c); **B**= Paratype 2 – Kwajalein, Marshall Islands, 2011, 26.9 mm (SMC52b.001f); **C**= Paratype 3 – Kwajalein, Marshall Islands, 2011, 34.9 mm (SMC52b.001b); **D**= Holotype – Kwajalein, Marshall Islands, 2011, 32.4 mm (SBRF TCMOL0004); **E**= Paratype 4 – Kwajalein, Marshall Islands, 2011, 46.6 mm (SMC52b.001a); and **F**= Paratype 5 – Kwajalein, Marshall Islands, 2011, 30.8 mm (SMC52b.001d).